

THE DIAGNOSIS AND PROGNOSIS OF TUBERCULOUS AND SEPTIC CONDITIONS OF THE KIDNEY.*

BY GEORGE E. ARMSTRONG, M.D.,
OF MONTREAL, CANADA.

COMPARATIVELY recent and more exact methods of determining the organic changes in and functional values of the kidneys together with the experimental researches of Hanau, Baumgarten and his pupils, Hansen and Guiani, as well as those of Wildbolz, have added materially to our knowledge of the diseases of these organs and to our therapeutic resources. The kidneys are, in the majority of cases, the first of the urinary organs to be infected by the tubercle bacillus. That one kidney alone may be affected at first, the other remaining free for a considerable time is a fact established by a large number of observations. It is with these cases of unilateral renal tuberculosis that we as surgeons are chiefly concerned, and this class includes according to Garrè and Erhardt about 10 per cent. of the tuberculous diseases.

Between June, 1905, and February, 1908, I removed 11 kidneys; 8 of these were tuberculous and 3 were cases of non-tuberculous pyonephrosis. Five of the patients were females and 6 were males. Of the 8 tuberculous cases 5 were males and 3 were females. The age in the tuberculous cases was from 21 to 41, the other 3 cases were aged respectively 48, 49, and 55.

The first symptoms in 3 of the 5 males were vesical tenesmus, frequency of micturition and hæmaturia. In one, frequency with pain but without blood, and in one, a sudden stoppage of the stream, followed by frequency. In the 3 women the first symptom was pain in the loin. Loss of weight was never a conspicuous symptom, although one patient had lost 30 pounds. Cystitis was present at the first examination in 6 cases; in 2 it was confined almost exclusively to the half

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of the bladder on the diseased side. In 4 cases there were present at the first examination a distinct ulcer around the ureteral opening in the bladder on the diseased side. In one case the ureteral opening in the bladder was swollen and œdematous, but not ulcerated. Tuberculous epididymitis was present in two cases. The relative dates of the development of the disease in the kidney, bladder, and testicle could not be determined.

The diagnosis was made in each instance by examining the individual separate urines from each kidney, and finding tubercle bacilli in the urine from the diseased side. This examination was also made to demonstrate the presence of a second kidney and the functional value of each kidney separately. The findings in 4 of these cases have been published in the "Montreal Medical Journal," and are referred to by Dr. R. P. Campbell in his paper published in the ANNALS OF SURGERY. The details of the remaining 4 cases are as follows:

A. B., aged 29; English cotton-mill operative; married. Was admitted to the Montreal General Hospital for pain in the right loin of 6 or 7 weeks' duration. Slight at first and of a dull, aching character, it gradually became worse and compelled her to give up work. She had lost in weight. Her nutrition was poor—mucous membranes pale. In the right loin was a mass which could be easily palpated and which was, apparently, an enlarged prolapsed kidney somewhat tender on pressure. Amount of urine excreted in 24 hours 32½ oz. It was found impossible to catheterize the right ureter. The urine from the left kidney was drawn by a ureteral catheter, and that from the right was obtained from the bladder. From the right kidney came only pure pus, in which no tubercle bacilli could be found. Around the orifice of the right ureter was an ulcer. The urine from the left kidney was as follows:

Left Kidney	
Sp. gr.	1015.
Reaction	Acid.
Urea	8 grs. to 1 oz.
Alb.	Trace.
	Sugar present after phloridzin.
	No tubercle bacilli.
	Cocci.

The right kidney and ureter were removed and the patient made an uninterrupted recovery. A year afterwards she was confined in the Montreal Maternity Hospital, when an examination of the bladder was made and the ulcer was found completely healed. The woman seemed in perfect health. The removed kidney was large, with scarcely any renal tissue left. It was composed of large pockets filled with pus. The pathologist's report was "Tuberculous pyonephrosis."

The 6th case. W. J. K., aged 41.—Complained of frequency of micturition. Had had appendicitis 18 months before, and the appendix was removed. His first symptom was in the fall of 1906, when a sudden stoppage of the stream was noticed, but it soon started again. Pain sometimes felt in the penis and the bladder, with increased frequency day and night. Has never noticed blood in the urine, which, however, has gradually become muddy and thick. During the summer of 1907, felt a pain in his loins. Has lost in weight. No history of fever or night sweats. Cystoscopic examination shows acute cystitis over the left side of the bladder with mucopus and doubtful-looking tubercles, more especially about the left ureteral orifice, which is very red, wide open and irregular in shape, slightly ulcerated, and in normal position. The right orifice is normal and the right side of the bladder is almost quite healthy in appearance. The bladder holds 6 oz. with difficulty. Neck of bladder bleeds quite easily. Ureters were catheterized and the urine gave the following analysis:

	Right Ureter	Left Ureter
Reaction	Acid	Alkaline.
Color	Clear, yellow	Pale, watery.
Sp. gr.	1026	1006.
Urea	2.9 per cent.	.6 per cent.
	Blood cells (traumatic)	Numerous tubercle bacilli.
	No pus	Pus in quantity.

The kidney was removed on January 31, 1908. Adhesions were considerable. The kidney was enlarged, rough in appearance, and the capsule adherent.

The 7th case, Mrs. J. S. C., aged 33; married; has had 2 children. Pulmonary tuberculosis diagnosed in March, 1905. Pain in the left kidney about the same time. Never had any

hæmaturia. Pus in the urine was first discovered in April, 1906. The examination of the urine gave the following:

	Common	Right	Left
		15 c.c.	5 c.c.
Color	Turbid	Slightly cloudy	Bloody.
Reaction	Acid	Acid	Alk.
Sp. gr.		1018	Not taken.
Urea		2 per cent.	No urea.
Albumin	Alb.†	Tr.	Alb.†††
Pus	Pus	A few cells.	Almost pure pus
Tubercle bacilli	Tubercle bacilli present	No tubercle bacilli	Tubercle bacilli present
Staphylococci		Staphylococci.	

On palpation the left kidney was found to be enlarged to nearly the size of a child's head and tender on pressure. The pulmonary lesion is reported to be perfectly healed. The discomfort in the left side is considerable, and the bladder irritation extreme. Micturition sometimes as often as every 20 minutes, and as often as 20 times in the night, accompanied by pain and occasionally a speck of blood.

I removed the kidney and the patient made a very smooth and uninterrupted recovery. In 4 weeks the pain associated with micturition had entirely disappeared and the intervals had increased to 3, 4, and sometimes 5 hours, and on one occasion 6½ hours.

The 8th case, M. W.; female, aged 30.—Early symptoms simulated nephrolithiasis. An examination of the urines at this time, September 17, 1907, gave the following:

	Right Ureter	Left Ureter
	10 c.c.	10 c.c.
Sp. gr.	1012	1022.
Reaction	Acid	Acid.
Color	Straw	Blood.
Urea	1.8 per cent.	2.6 per cent.
	Alb.	Alb. tr.
	12 m nec. to red. 1 c.c. of Fehling	3 m nec. to red. 1 c.c. of Fehling.
	Δ—61	Δ—1.46.
	Pus in quantity	No pus.
	No tubercle bacilli	Red blood cells traumatic.
	Large and small bacilli	

A diagnosis of stone was made and one of my colleagues did a nephrotomy. The pelvis and calices were dilated and a cavity was present in the upper pole but no stone was found. A sinus persisted and small perinephritic abscesses formed and were opened from time to time. The case seemed clinically to resemble very closely the condition described by Brewer as "Acute unilateral hæmatogenous infection of the kidney." On the 28th of November, 1907, the urines were as follows:

	Right Ureter	Left Ureter
Sp. gr.	1012	1022.
Reaction	Acid	Acid.
Urea	.6 per cent.	2 per cent.
	Pus	None.
		A few red blood cells (traumatic).
	Δ —75	Δ —1.14.

I removed the kidney on the 6th of December, 1907, and the pathological report was that it was tuberculous, the pyogenic infection being secondary.

The chemical reaction was in each instance alkaline. The urine from the diseased kidneys was never acid; in 3 the urine was alkaline and in 2 neutral. In 3 cases, only pus was obtained. As acid reaction is a characteristic of tuberculous pyuria and a neutral and alkaline reaction an evidence of mixed infection, it follows that in every case there was a mixed infection at the time of examination. A disagreeable odor was generally present in those that gave an alkaline reaction.

After establishing a diagnosis of tubercle in one kidney, it becomes necessary to estimate, if possible, the extent of the disease, the functional value of the kidney and also to demonstrate the presence of a second kidney and its functional value. In the very earliest stage it is often difficult to find tubercle bacilli. They may be few in number. In the late stages, when the kidney is little more than a pus sac they seem to have died out, and to be difficult to find in the pus coming from the kidney.

These results correspond closely with those of Ekehorn, who found bacteria relatively few in number in old cases in which the kidney after extirpation was found to be little more

than a pus sac with sclerotic walls and thin pus. The urine in such cases is very purulent and the bacteria few in number.

He reports a case of a woman 30 years of age who came into the hospital in 1902, with a diagnosis of tuberculosis of the left kidney. Numbers of tubercle bacilli were present in the urine—the disease was relatively recent. She was a strong able woman, and would not submit to an operation while she was free from pain. She left the hospital improved, and having gained 3 kilos in weight. In 1904, she was re-admitted to the hospital. During this period of 2 years she had worked hard and felt well. Her only complaint was of frequent micturition. The tubercle bacilli in the urine were few in number and the pus greatly increased in quantity. The extirpated kidney was found to be in a condition of fully developed tuberculous pyonephrosis with thin fibrous walls.

Another of his cases was that of a young woman aged 22, with tuberculosis of the right kidney. In June, 1906, after lifting a heavy load she suffered for a few days from a painful feeling in the right lumbar region. She felt the pain only when she bent forward or straightened up. It was not sufficient to prevent her from continuing with her usual work, and in a few days she felt quite well. On the 5th of October, 1906, blood appeared in the urine, and at the same time right renal colic—generally two attacks a day, each one lasting 15 or 20 minutes. This sometimes continued for a week, when she seemed to recover perfectly, and could do her work as usual. On the 16th of November blood reappeared in the urine, but without pain. There were no bladder symptoms. In the urine were found pus-cells and numerous tubercle bacilli with only a trace of albumin. The number of tubercle bacilli in this case was great, while the number of pus-cells was small with here and there a red blood-cell. Only 6 c.c. of urine came from the right ureter during an hour. The urine was not pale, but had a normal color. That from the left kidney was quite normal. The kidney was removed on the 23rd of November, 1906, and the extirpated kidney showed comparatively small changes. When the kidney was split it appeared for the most part sound. The chief changes from the normal were found in the three papillæ.

Ekehorn draws the following conclusions: Numerous bacilli may be found in the urine in very early cases and the number of bacteria found at different times vary during the different periods of the disease. When a new part becomes involved, the bacteria are more numerous. With numerous bacilli there may be a small quantity of pus and with a large amount of pus the bacteria may be relatively few in number. When the pus is in large quantity and the bacteria few, the lesion is probably an old one with cavities and sclerotic walls.

If the pus in the urine is insignificant, then it is probable that no very large part of the kidney is involved, although many bacilli may be present.

The functional value of the diseased kidney is difficult to determine with certainty. A small amount of disease may materially lower its efficiency. This is very well shown in one of my cases where the kidney involved excreted urine turbid in color and neutral in reaction, sp. gr. 1007, urea 1.1 per cent., and only a trace of albumin—sugar present and a freezing point of -0.35° —pus and tubercle bacilli. When the kidney was removed nothing was evident on or beneath the capsule, nor, indeed, was it at first apparent after longitudinal section had been made from pole to pole. On a more minute inspection one calix was found where all the points of the pyramids projecting into it showed macro- and microscopically typical tubercle formation. Hæmaturia had been a prominent symptom in this case. The kidney was removed because the hemorrhages were so large and recurred so frequently that he was becoming decidedly anæmic.

To establish the diagnosis pus must be found as well as tubercle bacilli, as in patients suffering from pulmonary tuberculosis the urine may contain tubercle bacilli and yet at autopsy no alteration in the kidneys be found. This has been noted by Jani and Schuschardt and others.

The determination of the functional value of the other kidney is of great importance and the results in my cases based upon an examination of the urine from this kidney have been found to truly indicate its efficiency.

LIEK, however, reports a case where such was not the case. The urines from the two kidneys in Liek's case were as follows:

Right	Left
15 c.c.	50 c.c.
Clear	At first turbid, later clear
Mildly acid	Alkaline
No sediment	Very rich in leucocytes
No albumin	Trace of albumin
After 0.01 Phloridzin: after 20 min. good reaction.	After 22 min. sugar reaction
Fr. pt. not taken.	Fr. pt. -0.60°

From these findings it was concluded that the right kidney was sound.

An operation was undertaken to remove the left kidney but the infiltration of the musculature was extreme, extended down to the true pelvis, and the kidney could not be made out. While searching for the left kidney the condition of the patient became so bad that the operation was abandoned and the wound tamponed. The patient died a few days later. At the autopsy, this right kidney, which had, seemingly, good functional capacity, was found very much enlarged, 3 or 4 times its normal size. After longitudinal section was made, the pelvis and calices were found very much dilated; the kidney parenchyma pale, yellow and containing many miliary abscesses. Microscopically it showed extreme changes about the parenchyma and interstitial tissue—cloudy swelling and necrosis of the epithelium, small-celled infiltration and miliary abscesses. As Lick remarks, the case would seem to indicate that these methods of determining the functional value of a kidney are only of relative value.

In a 21-year-old man suffering from rupture of the urethra and severe pyelonephritis of the left kidney, the right kidney gave a clear urine in sufficient quantity in typical intervals without sediment and without albumin. After the injection of 0.01 of phloridzin, good sugar reaction appeared in 20 minutes. The electric test seemed normal. From this examination the removal of the left kidney was considered. At the autopsy this, apparently, sound right kidney was found in a condition of extreme congenital deficiency and not sufficient to maintain the blood of proper density.

Descending renal tuberculosis would seem to be three times as common in women as in men. In 464 cases of Albarán, Facklam, König, Czerny-Simon and Vigneron there were 127 males and 337 females. The ascending form is confined almost exclusively to men.

The two sides are affected with almost equal frequency, although Küster, after examining a large number of cases, thinks there is perhaps a little preponderance of involvement of the right side and suggests the association of this condition with floating kidney.

There can be little doubt that renal tuberculosis is seldom, if ever, really primary. If it is true that 90 or 95 per cent. of all adults have, or have had, tuberculous lesions, it would certainly seem that the kidney involvement must be, as a rule, secondary to some glandular, pulmonary or other tuberculous lesion. Vigneron and Israel found secondary tuberculosis in

50 per cent. of cases of so-called primary renal tuberculosis. The kidney lesion may, however, be primary clinically, that is, it may be the primary lesion in the urinary tract and the only lesion active at the time, yet a careful study of autopsies renders it doubtful whether it is not in reality always secondary.

The bacilli are generally carried in the blood-stream, although the kidney may be infected by extension from adjacent tissues, particularly the peritoneum, and one cannot deny that possibly the infection may, in some instances, ascend from the bladder to the kidney. The preponderance of descending or hæmatogenous infection is well established by the studies of Steinthals, and Simmond's autopsy reports. Clinically, the renal may be of a truly primary focus. Of the primary lesion there may be no evidence as to its situation or even of its existence. Baumgarten's experiments indicate that tubercle bacilli never go against the stream either in the blood or in the lymph-vessels. He injected a highly virulent pure culture into the urethra of rabbits and attempted in that way to produce a tuberculous ulceration of the bladder and prostate, but he never got the infection to spread up to the kidneys or the epididymis. To produce an ascending infection of the kidneys, it was necessary, after injecting the ureter with the culture of tubercle bacillus, to put a ligature around distal to the injection, in that way arresting the flow of urine. There was the same difficulty in producing infection of the epididymis from the bladder. Albarran, Bernard and Salomon had the same experience, failing to cause changes in the kidney by injecting tubercle bacilli into the ureter until retention of the ureter was artificially produced by ligature. To produce infection of the testicle, the testicle itself must be injected, and then infection may pass along the duct to the prostate. On the other hand, Wildbolz seems to have succeeded in infecting the kidney from injection into the ureter without ligature.

Clinically the other kidney may become tuberculous after the first one. In these cases there is sometimes present a tuberculous cystitis with perhaps a tuberculous ulcer around the ureteral opening of the first side affected. In these cases

Tuffier thinks that the infection of the second kidney is an ascending one. This view seems to have some support from the recent experiments of Wildbolz, but it is not supported by Albarran, Bernard and Salomon, whose experiments would indicate that the second kidney like the first is a descending hæmatogenous infection.

There is little doubt that the cystitis is secondary to the renal infection in the great majority of cases. Just how long before the bladder becomes involved I have not been able to determine. Ulceration in the bladder seems to begin just at the entrance of the ureter through the bladder wall where there is a moderate narrowing as if the bacilli were detained at this narrow point and there get in their work. These ulcers are sometimes distinctly crater-like.

In one of my cases the bladder was examined 3 years after the onset of symptoms. Cystitis and ulcer were then present. There had never, in this case, been any pain or frequency. In the second case, although cystitis and ulcer were present, there were no symptoms. In the third case, symptoms of frequency and pain had been present for 6 months, and in the fourth for 8 months, and in these cases the bladder symptoms had been among the first and most prominent throughout the illness. In the fifth and sixth cases there was no cystitis and no ulcer; in the seventh and eighth the cystitis was confined almost entirely to the lateral half of the bladder on the diseased side, and in one of them, No. 7, there was also present an ulcer around the ureteral orifice of that side. In both Nos. 7 and 8, the opposite half of the bladder and opposite ureteral opening were normal.

I do not think that in the cases in which the bladder symptoms were primary the kidney lesion had been an ascending one. In two of them the kidney, when removed, was very extensively diseased, being little more than a pus-sac. The bladder symptoms rapidly improved immediately after the nephrectomy, and in the third although the kidney lesion was small the bladder immediately recovered, and has remained well ever since.

It would seem that renal tuberculosis may remain comparatively latent for a long time, giving rise to few symptoms perhaps for years. In the eight cases upon which I have operated the disease in the kidney was obviously much older than that in the bladder.

Five of my patients were males and two of them had an associated tuberculosis of the epididymis. In both of these cases there was also present cystitis with ulcer around the ureteral orifice. The time of incidence of these two conditions is not known because we have no knowledge of the time when the cystitis and ulcer appeared. It is altogether likely that in these cases the testicular infection is also hæmatogenous.

In 4 of Israel's cases there was besides the renal tuberculosis a tuberculous epididymitis without any disease of the bladder.

The combination of tuberculosis of the urinary and genital organs in women is a rare occurrence.

Küster thinks an ascending kidney tuberculosis is only possible by spreading from the mucous membrane or through antiperistaltic contraction of the ureters. This retroperistalsis has been observed, but it can take place only when there is a stricture in the lower end of the ureter analogous to the ligature applied by Albarran.

I have been unable to discover any predisposing cause in my cases. None of them had suffered from trauma, none of them admitted having had specific urethritis, in none of them was the condition obviously associated with floating kidney, and none of the kidneys removed showed any congenital lobulation or anatomical abnormality.

In 5 of these cases the kidney, when removed, showed very extensive caseation, breaking down of tissue in the centre and at both poles. In one the kidney was very hard and contracted; in one there was nothing outside of the kidney and but one calix where all the surrounding tissue was tuberculous, the disease spreading in the surrounding tissue to the depth of three-sixteenths to one-quarter of an inch, the whole disease

occupying about 9 c.c. of kidney tissue. In this case hemorrhage was a prominent symptom.

Zondek and Israel give an anatomical reason for the frequent involvement of the lower pole of the kidney, namely, the occasional existence of an artery springing direct from the aorta and going to the lower pole of the kidney so that the infection becomes localized.

In advanced cases I have found the fatty capsule altered, and very much adherent to the capsule of the kidney and in one it was indeed very difficult to separate it from the kidney.

Marked involvement of the ureter was present in two cases. The etiology of the changes in the ureter may vary in different cases, but the explanation given by Aschoff seems to harmonize very well with the clinical findings. Aschoff thinks that the involvement of the walls of the ureter is an ascending lesion, secondary to the ulcer in the bladder, the infection spreading upwards through the lymphatics from the ulcer at the ureteral opening in the bladder; the ulcer itself being a descending lesion.

Some cases have been reported in which the infection seems to have spread along the mucous membrane of the ureter by direct continuity from the pelvis of the kidney. In two of my cases all the coats of the ureter were involved. In one it was thickened and shortened raising the cornu of the bladder and rendering catheterization of the ureter difficult; in the other the walls were soft and friable—the ureter felt unusually large and œdematous.

Cases are reported in which ulceration of the mucous membrane of the ureter has been followed by cicatricial narrowing and even total obliteration.

The question of the frequency of involvement of the second kidney is of great interest. The following figures put together by Vigneron throw considerable light on this question: In 322 autopsies the disease was unilateral in 132 or 41 per cent.; in 326 operated cases the disease was one-sided in 198 or 60 per cent. These figures speak in a general way of the accuracy of the findings during clinical examination and

the operating table. By the time these people come to autopsy, it would naturally be expected that both sides would be involved in a much larger proportion of cases.

In another case many of the symptoms of tuberculous disease of the right kidney were present, namely, pain in the right loin and along the course of the right ureter, pain and frequency of micturition and pyuria, the patient gave a typical reaction to tuberculin, and no sign of any other focus could be discovered. Nevertheless no tubercle bacilli could be found in the urine. She improved under rest and dieting, and I did not recommend operation.

The temperature varies in these cases, and is generally elevated when ulceration of the bladder is present, but, as remarked by Garrè and Erhardt, it disappears almost at once after the kidney has been removed, although cystitis and the ulcer remain. They conclude that the only view to take of this is that the temperature was due to absorption of infected urine by the ulcerated surface.

There is nothing characteristic about the enlargement of the kidney in tuberculous disease. The enlargement is moderate in ordinary cases when due to caseation and excavation in the poles of the kidney. When a pyonephrosis develops the enlargement may be considerably greater. When one kidney is diseased and does its work imperfectly the other may undergo a compensating hypertrophy and the enlargement from this compensating hypertrophy has been mistaken for enlargement due to the disease and the wrong kidney removed. If ureteral catheter specimens are examined, this error can be easily eliminated.

The examination of the bladder is of interest and shows that the disease is first located at the ureteral opening on the diseased side and later in the trigonum.

In the diagnosis Garrè and Erhardt recommended palpation of the ureters through the rectum or vagina. Here one feels a distinctly thickened ureter on the diseased side as a tender cord. If all other methods of diagnosis fail, there remains exploratory incision and the treatment of whatever

condition may be found. The early symptoms, and indeed sometimes the later as well, suggest stone in the kidney. Colic may be present in both conditions, but pyuria is an early symptom in tuberculous disease, and a late symptom in nephrolithiasis, and later the pain and frequency in micturition is not such a prominent feature in nephrolithiasis as in tuberculosis. The duration of tuberculosis of the kidney may extend over a long period,—10 or 15 years according to Czerny-Simons.

The prognosis in renal tuberculosis is very bad when not relieved by operative measures. It would be interesting to learn the results of climatic and tuberculin treatment in a series of cases of early renal tuberculosis. With the knowledge at present available it would seem that nephrectomy is the safer and more conservative plan. As to partial nephrectomy, a careful examination of the kidneys removed has seemed to demonstrate that such an attempt must necessarily prove uncertain and unsatisfactory. The difficulty of locating the disease and removing it altogether even after complete longitudinal splitting of the kidney seems to us to be unsurmountable, and the literature contains many cases of this so-called conservative surgery of the kidney which have resulted in permanent fistulæ and subsequent nephrectomy. Bilateral disease, colic, hemorrhage, retention, or localized abscess are the conditions which Czerny and Israel consider to call for nephrotomy. These conditions demand a palliative operation. When one kidney is in a condition of pyonephrosis, but still secreting a urine of sp. gr. 1007 and 1008, while the other kidney secretes urine of the sp. gr. of 1010 or 1012, it is impossible to sacrifice any secreting tissue without imperiling the proper consistency of the blood. In such cases nephrotomy is justifiable. One must in undertaking nephrotomy under these circumstances be prepared to put up with the annoyance of a persistent sinus through which more or less purulent urine may pass.

In general, nephrectomy is the operation of choice if the disease is limited to one kidney, and is advisable not only to relieve the patient from that focus of disease, but to relieve

the good kidney from the extra work entailed by the diseased kidney. The contraindications against nephrectomy are absence or imperfect functional power of the opposite kidney, evidence of incipient disease of the other kidney as indicated by the presence of albumin, a few pus-cells with tubercle or other bacilli. Cases are reported in which after the diseased kidney has been removed the other has improved, the albumin and pus-cells in some cases disappeared altogether.

The kidneys have been removed in each instance with their capsule. In none of them was there any special difficulty; in none of them were there any adhesions to the vena cava; the peritoneum was adherent in one.

The ureter has, in each instance, been removed to the level of the brim of the pelvis or a little lower. I have adopted the plan suggested by Mayo and injected the distal end of the ureter with 20 min. of pure carbolic acid and then tied it. The recovery from operation has, in each instance, been satisfactory. There has been no operation mortality. The quantity of urine secreted is disturbed wonderfully little. The secretion during the 24 hours succeeding any operation is, as a rule, less than usual. In my cases the quantity increased day by day until the normal was attained. Hypertrophy of the remaining kidney has been noticed in some cases.

The subsequent history of these cases has been dependent very largely upon whether ulceration of the bladder was present or not at the time of operation. In my first case the patient recovered perfectly at the time—left the Hospital well, and I learned that he died some months afterwards of acute miliary tuberculosis. The second case a year after operation was still suffering from frequency of micturition, being compelled to get up 4, 5 and 6 times at night. Cystoscopic examination at this time showed that the ulcer present at the time of operation was still present, possibly not so deep, or quite so large, but not markedly changed. During the year his general health had improved, and he weighed more than ever before, but the washings were too painful to be carried out

regularly. He was put upon tuberculin and given an injection every 10 days. Since then he has steadily improved. No examination has been made of the bladder since, but in my last letter from him dated March 21, 1908, he was passing an average of 50 to 55 oz. a day. He can now go 3 hours at a time with ease, and sometimes 4 hours and is only up twice at night. This is the condition 15 months after the removal of the kidney. In another case where an ulcer was present the pain has all disappeared and the frequency of micturition is very much diminished. In still another 2 months after operation the pain and distress in urination and the frequency are not much less than they were before the kidney was removed. In this case, like the other, the passage of an instrument was so painful that the man refused to have it done. He is at present taking guaiacol, and if an improvement does not follow, I shall put him on tuberculin. These results are in marked contrast with the rapid and complete disappearance of pain and frequency after the removal of a nontuberculous pyonephrosis. In one such case all bladder symptoms had passed away completely 5 weeks after the kidney was removed.

The continuance of pain and frequency in these cases with ulcer raise the question if it would not be better to be more radical and to remove the whole of the ureter with the cornu of the bladder. This procedure, of course, adds considerably to the severity of the operation.

Tuberculosis of the genital organs or bladder may become an urgent reason for nephrectomy rather than a contraindication, the pain of the bladder and distress generally improving markedly after the kidney is removed. Early bladder disease will almost certainly recover as soon as the kidney is removed, and even extreme cystitis with ulceration around the ureteral opening may recover, particularly if the diseased cornu of the bladder itself is excised as recommended by Kümmell.

The results obtained in renal tuberculosis are improving. Schmieden collected 201 cases of nephrectomy after renal tuberculosis; of these 142 or 71 per cent. recovered, and 59 or 29 per cent. died. During the last 10 years the mortality

has not been more than 24 per cent. Israel reports 29 nephrectomies; of these 14 were primary with sound bladders; 11 recovered perfectly. Küster had 11 permanent recoveries in 17 cases of nephrectomy, Schede 16 in 22 cases and Czerny 11 in 27 cases.

In conclusion I desire to express my appreciation of Dr. R. P. Campbell's kindness and dexterity in catheterizing the ureters in the cases that I have reported.